ELECTRICAL CHARACTERIZATION AND BIOSENSING APPLICATION OF MODIFIED CARBON NANOFIBERS AND NANOCRYSTALLINE DIAMOND

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Abstract

Carbon-based materials, such as carbon nanofibers and nanocrystalline diamond, are attractive candidates for use in chemical and biological sensor applications. Recent studies have shown that when these materials are functionalized with biomolecules such as DNA, the biomolecules retain their activity and specificity. Furthermore these modified materials show very good stability and biocompatibility. Nanocrystalline diamond provides semiconducting properties while carbon nanofibers provide very high surface area, which can be used for new ways of detecting biological binding events, such as DNA hybridization, through electrical measurements.

We have been investigating the electrical properties of carbon nanofibers and nanocrystalline diamond. Measurements of the electrical impedance between 0.1 Hz and 1MHz were performed. The spectra show that the low frequency response is dominated by the capacitance of the system. Unlike simple planar surfaces, nanofibers arrays show a more complex dependence on frequency, which reflects the penetration of ions into the interstices between the nanofibers. The equivalent capacitance of these nanofibers is much higher than the capacitance of an equivalent planar surface, suggesting they may be useful as high density capacitors.

We have also examined nanofibers arrays in which the nanofibers have been covalently linked to biomolecules such as DNA and have investigated how the electrical properties change in response to biological binding events. Our initial results show that biomolecular recognition events can be detected using electrical measurements. The results of these data will be presented and the potential use of nanofiber arrays for biosensing will be described.

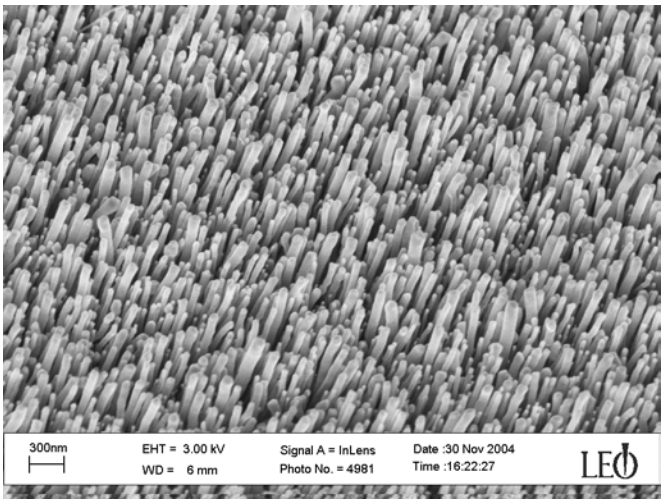

Figure 1: A scanning electron micrograph of carbon nanofibers

REFERENCES

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